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AGRICULTURAL MEMORANDUM NO. 910

Accumulated Degree-Days above 10°C : 1980 compared with other years, with special reference to viticulture in the South West Region.

Cochrane (1974) stated that examination of meteorological data for vine regions in Europe (Berrysmith 1968; Nakagaua 1968) suggested that commercial viticulture is not carried on where the accumulated sum of degree days above 10°C falls below 1000. Study of the accumulated temperatures over England and Wales for the decade 1961-70 did not show any station with average values up to 1000 degree days. Nevertheless, viticulture is practised on a commercial scale in southern England, and Cochrane further stated that the distribution of existing vineyards could be accounted for by accepting a threshold of 750 degree days for standard meteorological exposures and then relying on advantages of siting to provide the extra 250 degree-days required. He also produced a map showing areas where the average number of degree-days above 10°C reached or exceeded 750.

Cochrane also gave an account of comparisons of temperature measurements within a vineyard at Hambledon and those made at 3 standard meteorological sites during the cold summer of 1972. He concluded that though the vineyard might have enjoyed a slight advantage over the standard sites, the advantage was insufficient to increase the accumulated degree days above 10°C to 1000 or above.

The increasing interest in vine growing noted by Cochrane received an enormous boost in the 2 years following the publication of his paper, and the euphoria managed to survive the next 3 summers which were, on the whole, cooler than average. The advent of a fourth successive cool summer in 1980 has led to some cautionary comment in journals, counter-comment by established vine growers, as well as questions by members of the Agricultural Development and Advisory Service (ADAS).

This note is intended to put into perspective the 1980 season in the ADAS West Midland and SW Regions, and to try to point out some differences which seem to be indicated by the figures for different areas. There is a possibility that the differences to be described are spurious because the totals of degree days which result from the method of calculation used can be altered quite a lot by changes in either the mean maximum or mean minimum temperatures used. In fact, in checks for consistency between stations some cases came to light where some doubt must be cast on the values taken from the Monthly Weather Report.

The method used to calculate the number of degree-days above 10°C is to take the monthly means of daily maximum and minimum temperature and obtain a mean daily value of the number of degree days and then multiply this number by the number of days appropriate to the month. The method underestimates the heat sum especially when the mean minimum is well below 10°C, but otherwise the differences are quite small and in warm seasons the method works very well. In cold months - especially May and October - the underestimate may be as much as 20 degree days. Adjustments have not been made to the figures quoted in this paper but an approximate adjustment for May and October based on a few years data only is given by the expression:

$$\text{Adjusted Degree-Days (above } 10^{\circ}\text{C)} = 25 + \tfrac{7}{8} \text{ Calculated Degree-Days}$$

As a result of enquiries about 1980 figures for Exeter Airport and Malvern had already been calculated, and figures for a number of stations for earlier years were already to hand, so that when there was some correspondence in the 'Grower' following an article about a rather poor season at Efford Experimental Horticulture Station it was decided to have a closer look at the figures for 1980 in relation to past seasons.

With the exception of Boscombe Down Airfield all the stations are in areas shown on the map in Cochrane's paper as "possibly being suitable for viticulture in selected sites". The periods for which data were available differ from station to station and there have been some changes of site but these have been ignored for the time being.

For year to year comparisons the sums of degree-days above 10°C were placed in rank order, and details of the sums and rank order for 1980 together with station details are shown in Table I and Table II.

TABLE I

ACCUMULATED DEGREE-DAYS ABOVE 10°C

Station	Height above MSL m	May to October				Period for which data were used
		Average	Median	1980	Rank	
Malvern SO 790461	62	807	804	780	16	25 years 1956-1980
Pershore, College of Horticulture SO 959449	40	802	791	758	17	24 " 1957-1980
Efford EHS SZ 302937	16	777	778	751	16	26 " 1955-1980
Hurn Airport SZ 117978	10	760	753	721	12	18 " 1963-1980
Yeovilton Airfield ST 551237	18	769	764	716	12	16 " 1965-1980
Exeter Airport SY 001933	32	780	783	736	22	30 " 1951-1980
Long Ashton ST 537699	51	769	771	734	20	30 " 1951-1980
Boscombe Down SU 172403	126	732	725	673	22	30 " 1951-1980

TABLE II

Rank Number of the heat sums for various periods in 1980

	May to August	September	May to September	October	May to October	Number of years
Malvern	14	3	13	24	16	25
Pershore	16	3	15	23	17	24
Efford EHS	15	4	12	25	16	26
Hurn Airport	11	1	9	17	12	18
Yeovilton	11	1	9	15	12	16
Exeter Airport	22	2	19	28	22	30
Long Ashton	18	4	17	29	20	30
Boscombe Down	21	7	17	29	22	30

As far as possible stations with similar periods of records and those in similar areas have been placed near to one another in the tables.

It may be seen from Table II that for the periods May to August and May to October the totals for 1980 come about $\frac{2}{3}$ the way down the rank order and even with that lowly position the totals at Malvern, Pershore and Efford achieved the figure of 750 dd suggested by Cochrane for the period May to October. It may be seen from Table I that whilst the totals for the season for most of the stations failed to reach the 750 dd, the values for the 2 stations in Worcestershire, Malvern and Pershore, did so with something to spare. Calculations for Gloucester, Innsworth, show a May to October total of 777 dd, so that it seems that area of the lower Severn Valley did experience rather more warmth (as measured by degree-days above 10°C) than the other areas considered by this paper. To some extent this fits in with the pattern of questions and even statements of discontent about the summer which arose from the latter areas whilst some qualified satisfaction was expressed from Gloucestershire.

On accumulated degree-days above 10°C alone, 1980 was not by any means a particularly bad year. One feature which must have been disappointing was the poor performance of October following a warm, if at times wet, September; and since the period during which the crop matures usually extends into October the coldness of the month must have been a severe blow, but there was no right to expect that the run of 3 warm Octobers would continue.

Another unfortunate feature of October 1980 was the occurrence of some of the coldest weather before the middle of the month, and the greater part of the contribution to the heat sum above 10°C was during the third week - by then probably too late to be very useful. Examination of the figures for past Septembers and Octobers suggests that the relative size of the contributions for the earlier part of the season are larger in the north. This is shown in Table III.

TABLE III

Accumulated degree-days above 10°C

(a) in 1980
(b) average values for the period shown in Table I
(c) median

	May to August			May to September			September			October			September plus October		
	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
Malvern	601	630	618	758	756	758	157	126	127	22	51	52	179	178	171
Pershore	580	623	607	737	748	744	157	126	125	21	53	51	178	179	178
Efford EHS	559	578	567	724	710	714	165	135	137	27	67	69	192	202	192
Hurn Airport	538	577	552	693	699	693	155	122	125	28	61	61	183	183	183
Yeovilton	536	585	559	689	707	695	153	122	125	27	62	60	180	184	183
Exeter Airport	541	588	580	704	717	720	163	129	133	32	62	60	195	191	191
Long Ashton	553	592	582	710	714	725	157	123	124	24	54	49	181	177	175
Boscombe Down	509	567	550	653	684	680	144	118	121	20	47	43	164	165	163

This reversal of relative contribution to the heat sum could be taken to imply that there is a rather more abrupt end to the season in the SW Midlands than in the more southern areas. It also suggests that whilst it may be convenient as an exploratory step to delineate areas which have average totals of degree days above 10°C of 750 and above, some attention should be paid to the contributions of different parts of the season to the total, in particular the contribution of September and October. In this connection it is of interest to look at figures derived from averages of temperature at stations near the Rhine and its tributaries.

TABLE IV

Averages of Degree-Days above 10°C

	Data Source	Height above MSL	May to August	September	October	September plus October
Basel 1931-60 47° 33' N 7°	Met O 856 C	317	944	180	51	231
Freiburg im Breisgau 48° 01' N 7° 50' E 1931-60	856 C	259	902	168	34	202
Strasbourg 48° 33' N 7° 38' E 1931-60	856 C	149	902	151	35	186
Echternach 49° 49' N 6° 25' E 1949-60	856 C	164	777	148	35	183
Long Ashton 1931-60	735	51	619	125	47	172
(For comparison) 1951-80			592	123	54	177

It should be evident from Tables III and IV that at no station in England do the totals of degree-days above 10°C for the period May to August approach anywhere near the totals at stations on the Continent. However, the situation changes during September and the average heat sums for September and October for the English stations, especially those in the south, are on competitive terms with some of those on the Continent. Of course the recent run of Septembers and Octobers with temperatures rather above average may have caused some complacency, and there may well be some dismay if a similar years run of years with cool autumn months should follow.

Tentatively from Table IV it looks as if 180 d.d or thereabouts might be a safe lower limit for the September and October sum in order that satisfactory maturing of the crop will occur. Subtracting this figure from 750 gives a value of 570 d.d for the period May to August. From the data used the probability that 570 d.d will be reached or exceeded by the end of August is $14\frac{1}{2}$ years in 20 at Malvern and Pershore
12 years in 20 at Long Ashton and Exeter
$11\frac{1}{2}$ years in 20 at Yeovilton
11 years in 20 at Efford and Hurn

If, however, average values for the September and October sum for individual stations are used instead of 180 d.d the probabilities are more or less unchanged at Malvern, Pershore, Long Ashton, Yeovilton and Hurn but they become

13 years in 20 at Exeter
and 12½ years in 20 at Efford

It seems from the study of the figures from these stations that the lower Severn Valley is the most favoured area but even there a very careful choice of site must be made. The uneasy feeling persists however that a return to rather cooler Septembers and Octobers would be disastrous for viticulture even in the most favoured sites.

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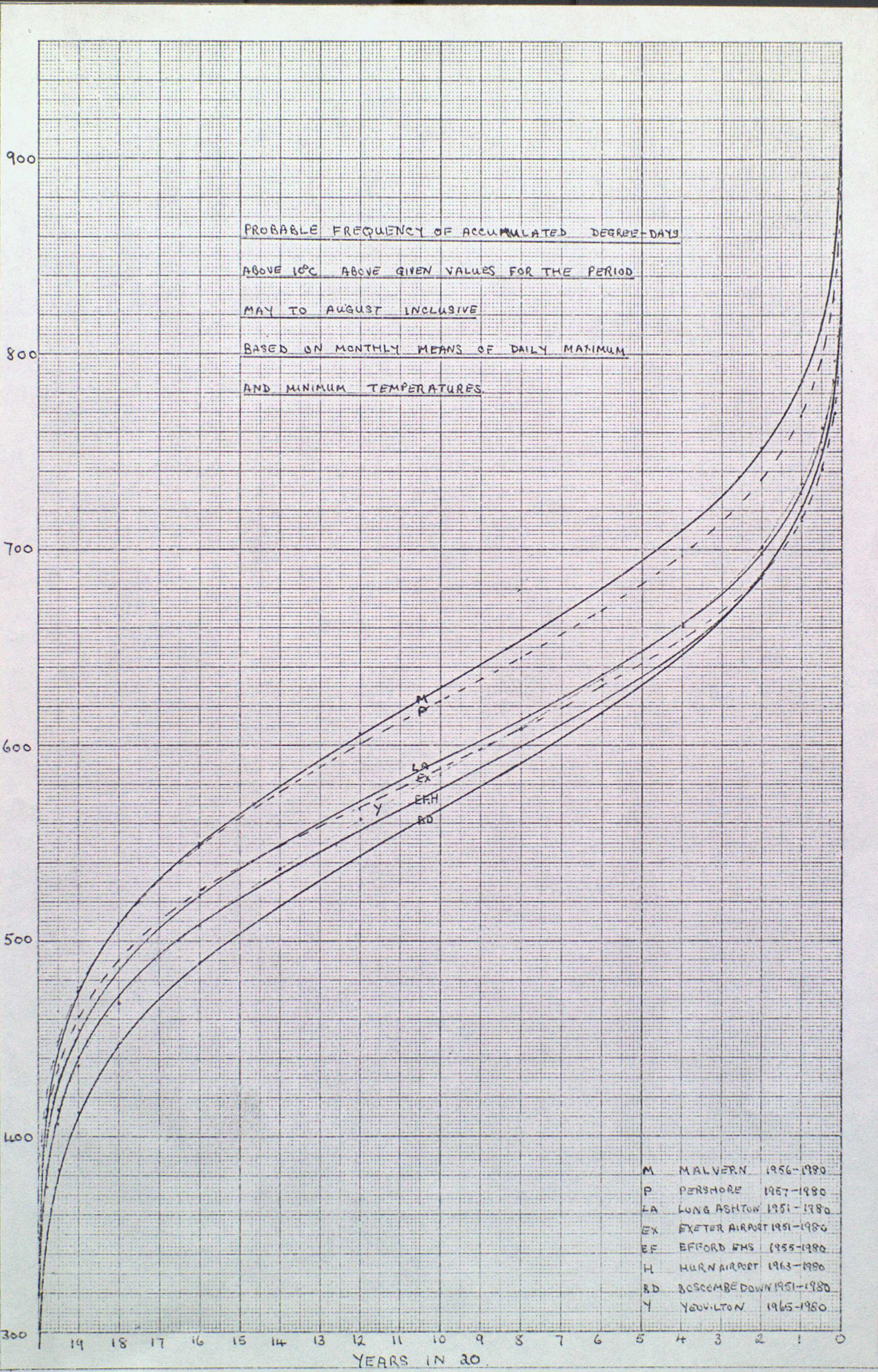
February 1981

REFERENCE

Cochrane J 1974 Meteorological Observations in Hambledon Vineyard in 1972
Royal Met Soc Weather 29(4) April 1974

Any comments or suggestions should be sent to the author.


PROBABLE FREQUENCY OF ACCUMULATED DEGREE-DAYS
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MAY TO AUGUST INCLUSIVE
BASED ON MONTHLY MEANS OF DAILY MAXIMUM
AND MINIMUM TEMPERATURES.
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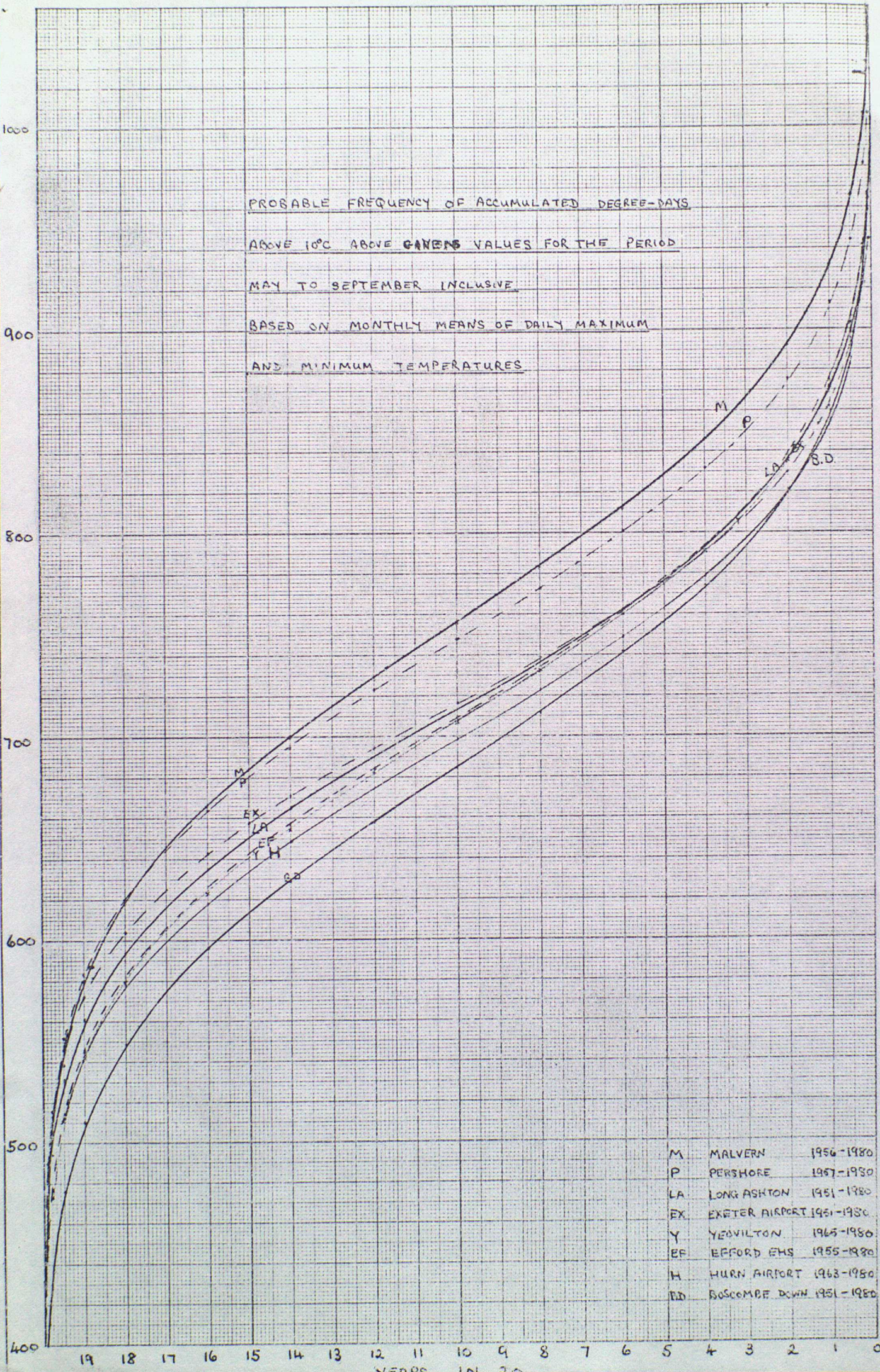
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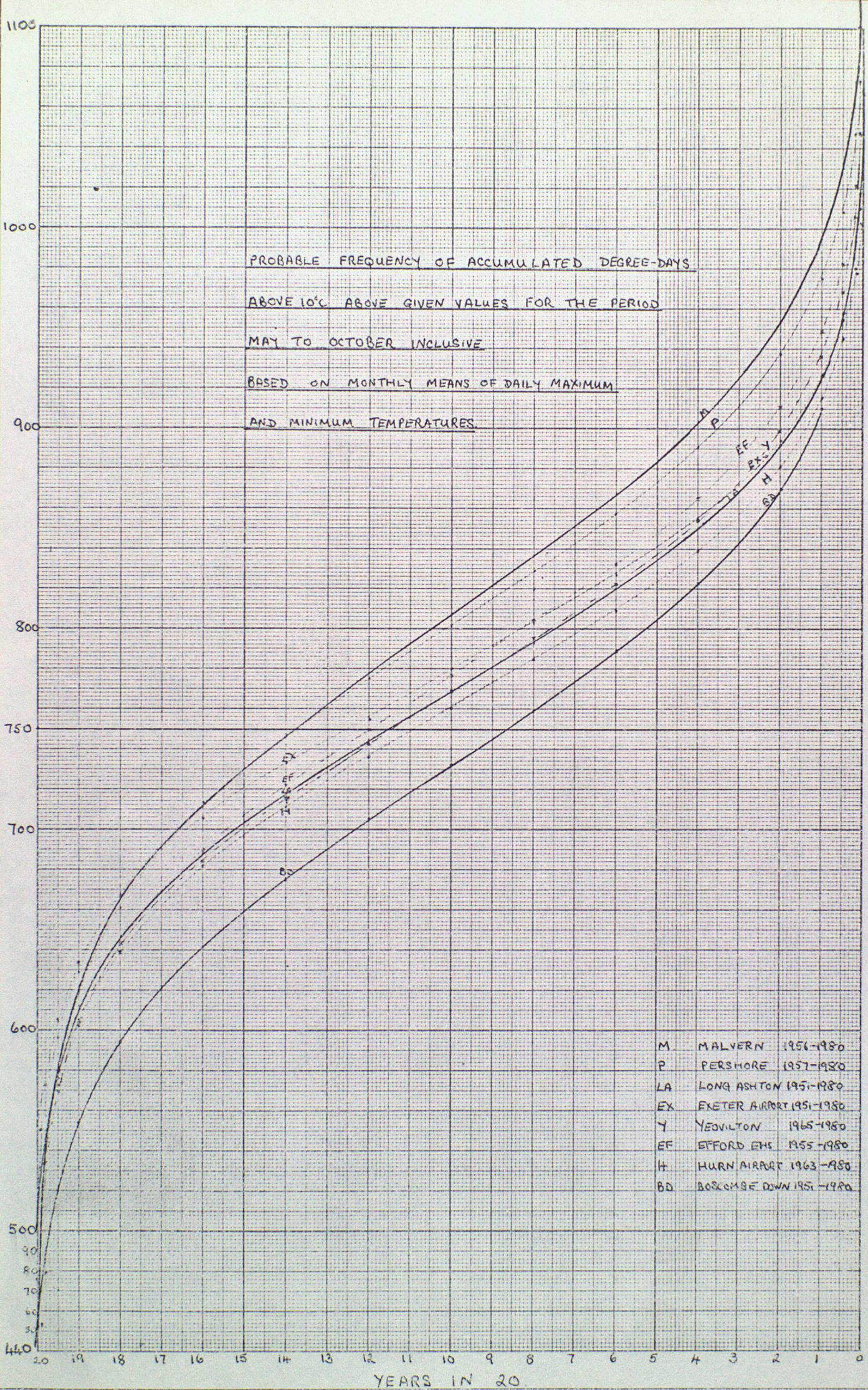
PROBABLE FREQUENCY OF ACCUMULATED DEGREE-DAYS ABOVE 10°C ABOVE GIVEN VALUES FOR THE PERIOD MAY TO OCTOBER INCLUSIVE BASED ON MONTHLY MEANS OF DAILY MAXIMUM AND MINIMUM TEMPERATURES.
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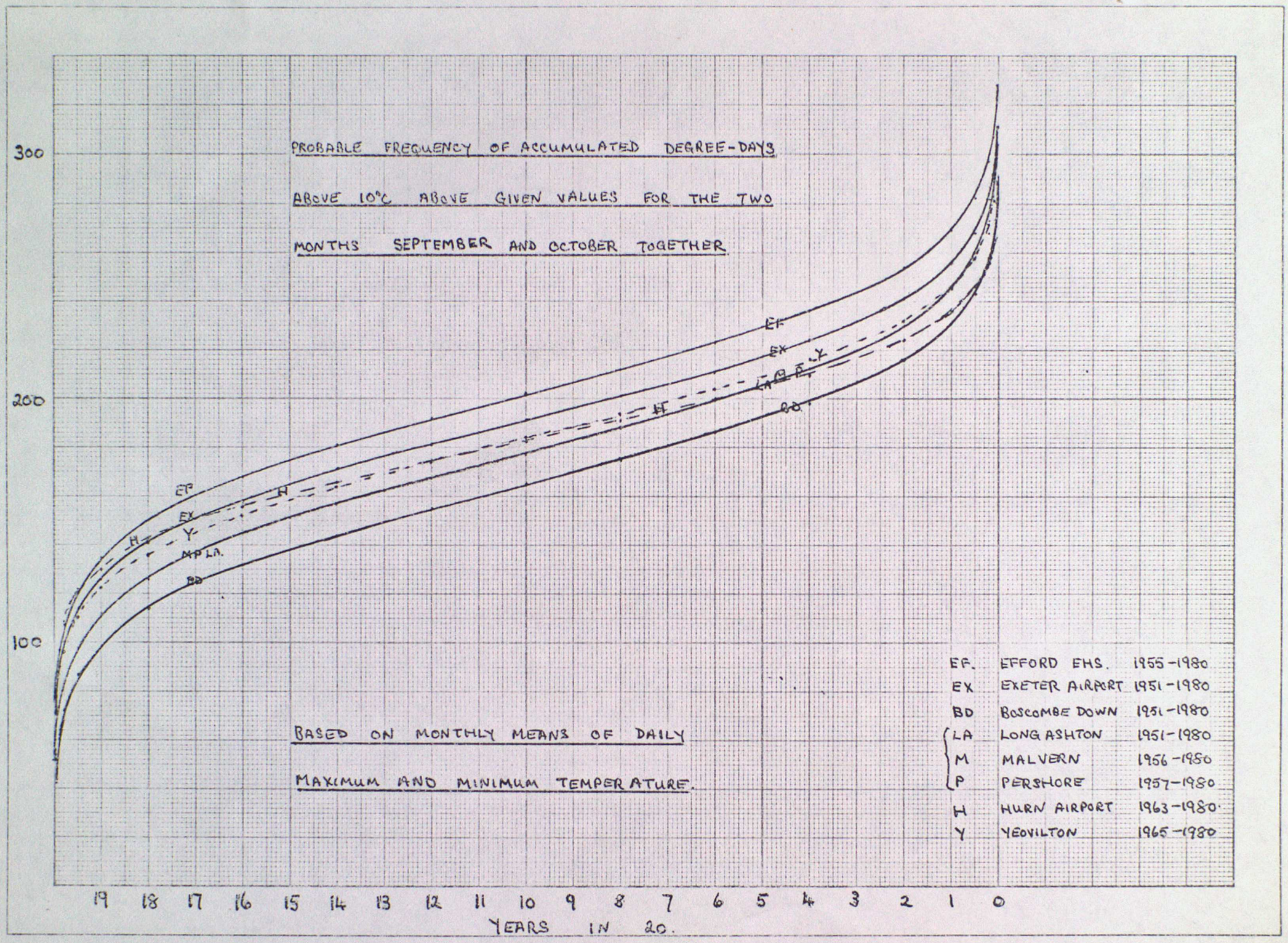
YEARS IN 20


PROBABLE FREQUENCY OF ACCUMULATED DEGREE-DAYS
ABOVE 10°C ABOVE GIVEN VALUES FOR THE TWO
MONTHS SEPTEMBER AND OCTOBER TOGETHER.
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BASED ON MONTHLY MEANS OF DAILY
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YEARS IN 20.
EF. EFFORD EHS. 1955-1980
EX EXETER AIRPORT 1951-1980
BD BOSCOMBE DOWN 1951-1980
LA LONG ASHTON 1951-1980
M MALVERN 1956-1980
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Y YEOVILTON 1965-1980